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Turtles and Highways:



Crossing the Killing Zone

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From flimsy fences to a grassroots effort to build an ecopassage

By Matthew J. Aresco

The roar of an 18-wheeler is followed by a blast of air as it passes. Hidden in the low brush at the edge of U.S. Highway 27 near Tallahassee, Florida, is a Florida cooter, a turtle that hatched from an egg on the shores of Lake Jackson fifteen years ago. She lived well in the lake and grew large, but today she must leave. The lake waters have been slowly receding for months, so this morning she crawled out of a muddy, drying pool to begin a dangerous migration to find new water. Ancient instincts direct her west;

somehow she knows that there is water in the distance. She forces her large, armored body through the thick vegetation, and by afternoon she slowly climbs the steep slope that leads to the highway, sliding back down several times before reaching the top. After pausing to rest, she leaves the cover of the roadside brush and stretches her neck, using all her senses to guide her. Water and a new home are only a few hundred yards away, but the landscape between her and her goal is unfamiliar. She cannot know that the short stretch of open ground ahead is a killing zone for turtles, only that she must get to the other side.

Driving north on U.S. 27, I squint and see the familiar silhouette a quarter mile away. I quickly pull my truck off the road,

get out, and race toward her. I would only have a few seconds to save her. A line of rush hour traffic is rapidly approaching, and the turtle has paused in the center of the northbound lane, confused and trying to get a bearing on her position. Seeing me running towards her, she pulls her head into the safety of her shell, not aware that the real danger is the rolling

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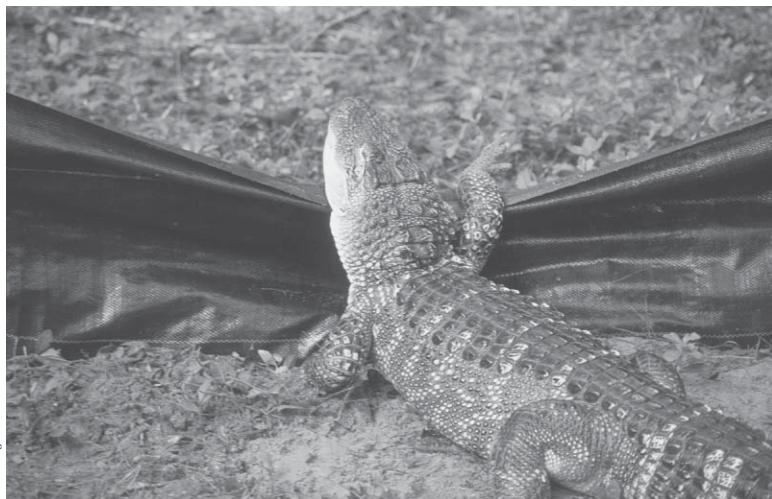
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thunder of the machines piloted by motorists oblivious to her plight. I snatch her off the road and look back as twenty sets of wheels rocket over the spot where she had rested only a few moments ago.

Scattered along the highway lay the remains of turtles that had not been so lucky. On that day, I counted 90 dead turtles along a third of a mile section of the northbound side of U.S. 27. Here, the four-lane highway was built directly across a three-quarter mile section of Lake Jackson in the 1960s, isolating a 50-acre part of the lake to the west, now known as Little Lake Jackson. Lake Jackson is a 4000-acre State Aquatic Preserve in northwestern Florida, located seven miles north of Tallahassee. It is typical of lakes in this region, dominated by thick aquatic vegetation and having a relatively shallow, flat-bottomed basin with underlying limestone.

Lake Jackson is a closed basin and the water depth fluctuates widely, controlled naturally by variations in rainfall and by two sinkholes. During drought conditions, a lowering of the water table causes leakage into the groundwater through the sinkholes, and most of the lake bottom dries; this has occurred nine times during the last 100 years, drying on average every twelve years.

The highway was built before State and Federal wetland protection laws were enacted, and the lake bottom was filled with dredge material and concrete rubble. Little Lake Jackson has no active sinkholes and is a deep arm of the lake that was once part of an old river channel. This road connects north Florida and south Georgia to Interstate 10, which brings motorists to Tallahassee and points south. With an average traffic volume of 23,000 vehicles per day, U.S. 27 is an impassable barrier to turtles and a wide range of other wildlife—a classic case of poor transportation planning that does not take wildlife



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movements into consideration.

Preparing for the Migration

As spring approached in 2000, and dozens of dead turtles began to accumulate daily along the highway in February and March as they left the drying lake, I spent many hours patrolling the roadside for migrating turtles. While Lake Jackson was slowly drying, Little Lake Jackson still had plenty of water and the turtles knew it. I knew I was watching what was only the beginning of a massive migration of turtles that would attempt to cross the highway in the coming months. After I first discovered signs of the coming migration, vehicles killed 343 turtles in just 40 days between 22 February and 3 April 2000: Florida cooters, yellow-bellied sliders, musk turtles, mud turtles, Florida softshell turtles, snapping turtles, and box turtles—big and small, new hatchlings, and 40-year-old adults—the highway is a blind and systematic killing machine. Time after time, dangerous rush hour traffic forced me to stand helplessly on the highway shoulder just a few feet away from the obliteration of a 20- to 30-year old turtle that I could not save. Anger, sadness, frustration, and a deep love for these slow-moving animals motivated me to find a solution to the problem.

I contacted the Florida Department of Transportation and proposed a simple, low-cost, temporary solution—a low fence that would prevent turtles from crossing

the highway and instead direct them into a large drainage culvert that connects Lake Jackson and Little Lake Jackson. The department agreed to donate some material, 2-foot-high woven nylon silt fencing attached to wooden stakes, the same erosion control fencing used on construction sites. (I did not use wire fencing because even small mesh sizes would allow small turtles to pass through.) I constructed 3,000-foot fences along the margin of each side of U.S. 27.

The bottom edge was buried

ca. 6-8 inches so that the above ground height of the fence was ca. 18 inches. The north and south ends of the fences were turned back gradually towards the lake at least 300 feet to prevent animals from simply wandering around the ends and onto the highway. Many turtles such as snapping turtles, softshell turtles, box turtles, and musk turtles are exceptional climbers and the fences were angled inward slightly to minimize this problem.

Monitoring and Rescuing the Turtles

The turtle fences were completed just in time. The month of April 2000 was exceptionally dry, and hundreds of turtles continued to migrate toward Little Lake Jackson. I monitored the fence daily and collected turtles walking along the fence and transported them across the highway in large plastic containers—sometimes toting six 18-gallon tubs full of turtles at a time. The fences required vigilant daily monitoring to remove turtles from behind the fences before they either overheated in the hot sun or were killed by nocturnal mammalian predators such as raccoons. Some turtles were observed crossing under the highway through the culvert without being carried across, but with only one culvert along a 4000-foot stretch of highway, many were not able to locate it.

From April to August 2000, I counted almost 5,000 turtles that left Lake Jackson and were intercepted by the fence before they reached the highway. Pulses of move-

ment by turtles corresponded to the dry down of several large pools—what remained of Lake Jackson—during the spring and early summer. During the intense heat of the day, turtles would burrow into the soupy mud amidst the dead and dying catfish, bowfin, and gar. In the early evening, turtles of all sizes—from large adults to hatchlings no larger than a quarter—would emerge by the hundreds, caked in mud, and begin migrating in unison towards the sun setting over Little Lake Jackson. As the lake dried, some turtles traveled almost a mile before they reached the fence. Their shells and limbs often bore testament to the dangers of being a turtle, from deep boat propeller scars to alligator bite marks. As the final pool dried to cracked mud in late June 2000, I was finding 200 turtles per day at the fence. Moving along with the turtles was a menagerie of other reptiles and amphibians, including numerous green water snakes, banded

water snakes, mud snakes, water moccins, pig frogs, leopard frogs, and alligators, and these animals were also carried across the highway. Alligator tracks were frequently observed in the culvert. By the end of July, the northwest part of Lake Jackson was completely dry, and the turtles were safely in Little Lake Jackson. One can imagine the carnage along the northbound lane of U.S. 27 if the fence had not been there.

Following Their Return Passage

Turtles began migrating back to Lake Jackson following heavy rains in September 2000, and the return migration accelerated in spring 2001. In 2001, 3,300



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turtles migrated from Little Lake Jackson back to Lake Jackson as heavy early spring rains and two tropical storms refilled it. Once again, the temporary fences, combined with intensive daily monitoring, saved 99% of the turtles from being killed on the highway.

When the drought finally ended and the lake refilled, I hoped that the attempted crossings of turtles and other species would subside. But the turtles kept on coming; road mortality and attempted crossings of turtles on U.S. Highway 27 is clearly greatest when drought conditions cause Lake Jackson to dry and during subsequent return migrations when the lake refills, but turtles also attempt to cross the

highway under normal conditions such as nesting in spring and summer, local migration and dispersal of males and juveniles, and newly emerging hatchlings searching for water. Highway roadsides create artificial disturbed and open habitats that may be attractive, but deadly, to nesting females. If more females than males are killed on the highway each year, populations will eventually show severely male-biased sex ratios. Normally, sex ratios are nearly 1:1. At Lake Jackson, I found that sex ratios of three turtle species were dramatically male-biased (65–80% males), an indicator of the effects of long-term road mortality.

Tracking Their Numbers

After almost four years and over 6,000 hours of daily monitoring of the highway and fences, I found that road mortality and attempted crossings of turtles at U.S. 27 are higher than has been documented anywhere else: 8,842 turtles of ten species on a three-quarter-mile stretch of highway. Although some turtles climbed the fences and

some found their way around the ends, I was able to save over 8,100 turtles. Many other species of reptiles and amphibians are excellent climbers, and most of the 1,400 individuals of 34 non-turtle species found along the highway were killed by traffic.

Road mortality is an increasingly significant threat to the population viability of turtles.¹ Recent studies in other parts of North America provide strong evidence that local populations of freshwater and terrestrial turtles are reduced along highways by direct traffic mortality and the effects of habitat fragmentation. Populations of long-lived vertebrates such as turtles are likely to be especially vulnerable to road mortality. Demo-

graphic and life history traits of turtles, including long generation times and naturally high rates of egg and juvenile mortality, limit their annual recruitment, or the rate at which new individuals are added to the population. In healthy populations, these traits are offset by high lifetime fecundity as adults typically have few natural predators. However, turtle populations may not be able to compensate for sudden or chronic losses of large numbers of breeding adults, and even small increases in the annual mortality rates of mature females (< 10% per year) can lead to long-term declines with little or no population recovery possible.

At Lake Jackson, the number of females killed annually along the highway during nesting season could be sufficient to cause long-term population declines when combined with relatively slow growth to maturity (e.g., 10-12 yrs. for Florida cooters) and low levels of recruitment. Large numbers of turtles are road

killed during both periodic dry-downs and in years of normal lake levels. The mass migration and mortality at U.S. Highway 27 represent turtles from at least 25% of the total lake area (1000 acre northwest sub-basin); the loss of 25% of the entire turtle population every 12 years due to traffic mortality is a severe bottleneck event and a population sink (an area in which high mortality or low reproduction causes a local population decline). At Lake Jackson, 6-22% of females in each population are killed annually along the highway during nesting

season. The combined effects of annual road mortality and periodic mass mortality during droughts could potentially decimate entire populations of six turtle species at Lake Jackson: yellow-bellied sliders, Florida cooters, musk turtles, Florida softshells, mud turtles, and Florida snapping turtles.

Interpreting the Data

Without appropriate baseline data, it may be difficult to detect if turtle populations in areas affected by road mortality have already undergone historic declines



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If You Find a Turtle Crossing the Road...

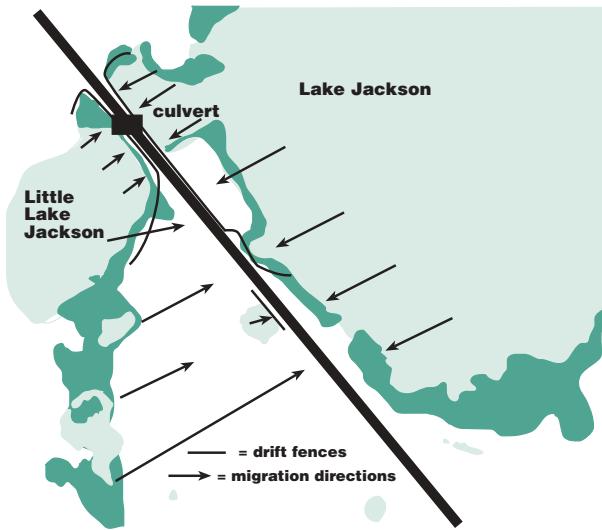
If you find a turtle crossing the road, you should move it across in the direction it was moving, if you can do so safely. If you cannot tell which way it was moving, then move it off the road on the side it was found. In either case, the turtle should be carried off the road as far as possible. Large snapping turtles or softshell turtles do not need to be picked up and can simply be dragged by grasping the rear margin of the shell or the tail. Although they may attempt to bite, they cannot reach around to the rear of their shell. An uninjured turtle found in the road should never be "rescued" by moving it away from its home habitat to some other area. In Florida, gopher tortoises are frequently moved by people with good intentions, but such relocations can spread disease (such as upper respiratory tract infections) among populations or result in tortoises being transported to unsuitable habitat. Relocated turtles will often attempt to return to their home habitat and will wander for days, again encountering roads or predators.

in population size. In this case, low but consistent annual road mortality rates may be causing long-term population declines that could eventually lead to extinction of local populations. Alternatively, recently abundant species may be experiencing dramatic reductions in population size and alterations in demography due to increased traffic volume and greater road kill probability. This scenario best fits the case of turtle populations near U.S. Highway 27 and many other highways in North America where formerly rural roads that historically allowed successful crossing of some turtles have experienced a 100-200% increase in traffic volume over the last two decades. For example, traffic volume increased by 162% from 1977 to 2001 on U.S. Highway 27. Predictably, the probability of a turtle successfully crossing U.S. 27 decreased from 32% in 1977 to only 2% in 2001.² Lastly, for new road construction, long-lived species with long generation times may exhibit a lag time between current road mortality rates and observable population declines. Clearly,

additional studies should be initiated throughout North America to carefully quantify both direct mortality and demographic effects. Conservation measures for freshwater turtles should consider their annual and seasonal overland movements that frequently require them to cross roads.

Addressing the Long-Term

How can we eliminate road mortality at Lake Jackson and elsewhere? Although the nylon silt fences were an effective short-term solution to the turtle road mortality



problem, they require constant maintenance and monitoring to remain effective. The fencing material degrades rapidly in direct sunlight and is easily damaged by mowers, vandals, ATVs, and storm water run-off. On several occasions, I found road-killed turtles next to single breaks in the fence. Also, because there is only one culvert for the entire stretch of highway, turtles have difficulty finding it, so they must be carried across the road or they may succumb to heat or predators as they search for a way across. Although I have been able to accomplish this task for the last four years, clearly, a more permanent solution to this significant wildlife mortality problem is needed, both for this stretch of U.S. Highway 27 and other high-risk areas.

A permanent wildlife crossing or "ecopassage," consisting of a guide wall and multiple culvert system, would solve this continuing wildlife mortality problem. Ideally, ecopassages should be designed to mitigate the effects of highway mortality and habitat fragmentation for the full diversity of fauna affected by a particular highway, including reptiles and amphibians. Therefore, rather than focusing on a single species, a multi-species approach that seeks to restore the ecological connectivity of fragmented areas should be the primary goal. An ideal prototype for a multi-species ecopassage design for reptiles, amphibians, and mammals was recently constructed by the Florida Department of Transportation at the Paynes Prairie State Preserve along two miles of U.S. Highway 441, south of Gainesville. This de-

sign consists of a lipped, four-foot-high concrete guide wall and a series of culverts. This system has proven effective in diverting wildlife from the highway, virtually eliminating mortality and facilitating under-highway movements.³

Mobilizing Local Effort

Over the last two years, I have begun a grassroots effort to work with the Florida Department of Transportation, Leon County government, and other agencies to secure funding and to assure the construction of a permanent ecopassage along U.S. 27 to prevent future mortality of turtles and other wildlife. I established a website, www.lakejacksononturtles.org, and a citizen's action group, called the Lake Jackson Ecopassage Alliance, in order to develop and demonstrate broad-based support for the Lake Jackson Ecopassage. Recently, the Florida Department of Transportation allocated \$125,000 for a feasibility study to determine the most appropriate design to solve this unprecedented road mortality problem and to reestablish natural migration patterns.

Although the design and construction of a permanent ecopassage may still be years away and funding sources remain uncertain, this is an important first step toward meeting Federal Highway Administration (FHWA) requirements for possible Federal funding or Florida Department of Transportation's Ecosystem Management funds. In the meantime, I continue to walk the fences and carry turtles across the highway in plastic containers with duct tape in hand to patch the holes. As I watch the rainfall deficit increase for 2004 and the lake level slowly drop, I ready the fences for another mass migration of turtles.

A Final Word

The migration of thousands of turtles at Lake Jackson and their ability to find water during drought is truly an incredible natural wonder. Turtles possess a tenacity for survival that reflects millions of years of adaptation to dynamic environments. Yet the resiliency of turtles is too

often overshadowed by their vulnerability to habitat destruction and fragmentation and the dangers of roads and highways. A migrating turtle knows where it wants to go and moves with single-minded purpose toward its goal. As stewards of the environment, we should follow that example and ensure that turtles and other wildlife are protected from the hazards that we create.

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(Endnotes)

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